SD 11
A5A15
#23

FOREST RESOURCES of SOUTH CENTRAL MONTANA

by

T. L. Finch · W. C. Hodge
and M. E. Metcalf

- Northern -
Rocky Mountain
Forest & Range
Experiment Station
Missoula Montana
Chas. L. Tebbe, Director

LIBRARY
JAN 7 1970
ROCKY MOUNTAIN STATION

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

STATION PAPER № 23

APRIL 1950

Prepared by the Division of Forest Economics

M. B. Dickerman, Division Chief

Statistical and inventory procedures were the responsibility of P. D. Kemp.

Field inventory work was under the supervision of C. W. Brown and W. C. Hodge. Assisting them in the field and in office computations were T. L. Finch, M. E. Metcalf, E. F. Peffer, H.J. Pissot, and J. H. Wikstrom.

Agriculture—Missoula

FOREST RESOURCES OF SOUTH CENTRAL MONTANA

By

T. L. Finch, W. C. Hodge,
and M. E. Metcalf

C O N T E N T S

	Page No.
The forest survey in Montana.	1
Forest land	2
Timber volume	3
Pole processing - a new industry.	4
High quality pulpwood	5
Eighty sawmills operate in the unit	6
Statistical data by county	
Table 1. Forest land area.	7
Table 2. Timber volume	8
Standard statistical data for unit	
Table 3. Land area by major use.	9
Table 4. Forest land area by economic class.	9
Table 5. Commercial forest land by species group and stand-size class	10
Table 6. Board-foot volume on commercial forest land by species.	11
Table 7. Cubic-foot volume on commercial forest land by species.	12
Table 8. Board-foot volume on commercial forest land by stand-size class and diameter group.	13
Table 9. Cubic-foot volume on commercial forest land by stand-size class and diameter group.	13
Table 10. Cubic-foot volume on commercial forest land by species group, tree size and class of material	14
Table 11. Average volume per acre by stand-size class . .	14
Definitions	15
Forest survey method.	16
Accuracy of the data.	17
List of forest survey reports for Montana	19

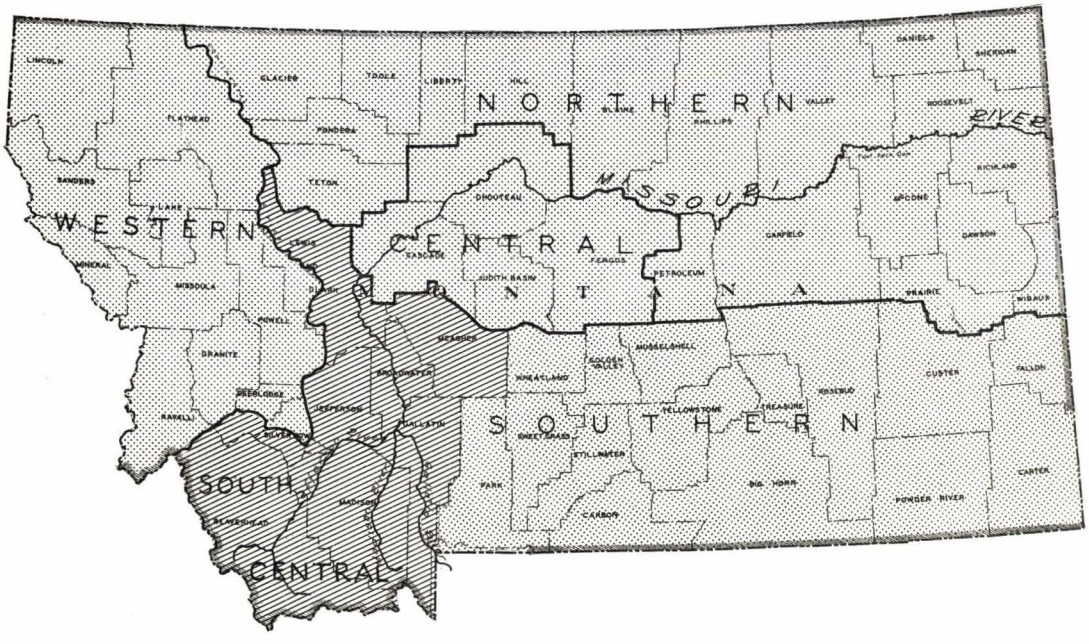
THE FOREST SURVEY IN MONTANA

A survey of Montana's forests was begun in 1934 as part of a Nation-wide inventory of the forest resources. Interrupted by the war, this survey was resumed in 1946 and field work was completed during 1949. From 1941 through 1949, 23 reports were published covering 47 counties and giving forest resource statistics by counties or groups of counties. With this release which covers 9 additional counties statistical reports for all of the 56 Montana counties will have been issued.

The station is now preparing a comprehensive analytical report on the forest resources of Montana which will summarize the data obtained to date. Because changes have occurred since the survey was initiated 15 years ago, new data are being compiled for some areas. Consequently, data from reports published to date will not necessarily add up to the totals given in the comprehensive report.

This final unit report presents basic inventory data on the extent of the forest land and the timber volume for the 9 South Central Montana counties indicated on the map below. Only those portions of Lewis and Clark, Deerlodge and Silver Bow Counties east of the Continental Divide are included. The field inventory for South Central Montana was made during 1947, 1948 and 1949.

FOREST SURVEY UNITS



AREA COVERED IN THIS REPORT

AREA COVERED IN PREVIOUS REPORTS

FOREST LAND

South Central Montana has 4.8 million acres of forest land and includes 9 counties. 1/ Beaverhead, the largest county in the unit, has more than one million acres of forest land. Also it has the greatest forest area of the counties in Montana east of the Continental Divide.

Approximately three quarters of the total forest area is classified as commercial forest land. The 1.2 million acres of noncommercial forest area include the Anaconda-Pintler and the Bob Marshall primitive areas east of the Continental Divide and a section of Yellowstone Park in Montana. These noncommercial areas have some of the most beautiful mountain scenery in the West.

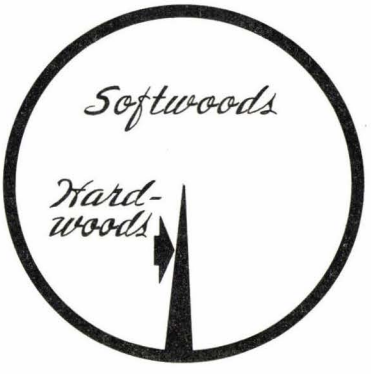
The South Central unit lies at the headwaters of the Missouri River and is one of the largest forested areas in the upper Missouri Basin. Within the unit the Gallatin, Jefferson, and Madison Rivers meet to form the Missouri. The Dearborn, Sun and Smith Rivers all originate in the forested mountains of South Central Montana.

Forests of the area are almost entirely coniferous. The pattern in the foothills is usually one of juniper, ponderosa pine, or Douglas-fir in pure or mixed stands. At higher elevations lodgepole pine is found in extensive pure stands. On the lower fringe of the lodgepole pine type it is common to find a narrow belt of Douglas-fir. Spruce of commercial quality occurs generally in stringers along the creek bottoms. Near the Continental Divide, which forms the west and south boundary of the unit, and on the tops of other mountain ranges is the subalpine noncommercial forest containing such species as limber pine, white-bark pine, spruce, alpine fir, and alpine larch. Intermittent stringers of cottonwood occur along the banks of the larger streams.

37 % OF THE TOTAL AREA IS FOREST LAND

75 % OF THE FOREST LAND IS CLASSED AS COMMERCIAL

98 % OF THE COMMERCIAL FOREST IS SOFTWOOD



1/ See page 15 for definition of terms used in this paper.

TIMBER VOLUME

The 9 counties in the unit have nearly 5 billion cubic feet of timber on commercial forest land. Conifers make up 99 percent of the volume. Of this lodgepole pine comprises 51 percent, Douglas-fir 32 percent, and Engelmann spruce 8 percent.

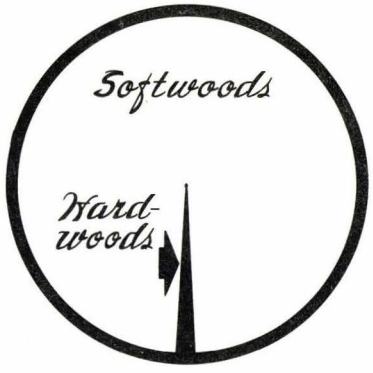
Most of the trees in South Central Montana are in the smaller diameter classes. Nearly three fifths of the cubic-foot volume is in pole-size trees (5.0" to 10.9" d.b.h.). This relatively high proportion of pole-tree volume for western coniferous forests is accounted for by the large number of dense lodgepole pine stands. More than 86 percent of the cubic-foot volume in saw-timber trees is in the 12.0" to 20.0" d.b.h. group. Almost 80 percent of the 3 billion cubic feet in pole-size trees is found in pole stands. Most of the volume in pole stands is lodgepole pine. Because of these conditions mine timbers, transmission poles, and pulpwood are currently the major forest products.

There are nearly 11 billion board feet of saw-timber volume on the commercial forest land. It is largely concentrated in three species: Douglas-fir 45 percent, lodgepole pine 30 percent, spruce 16 percent, other species 9 percent. Nearly two thirds of the board-foot volume is in saw-timber stands. The remainder is in pole stands, in open woodlands and as a residual volume in very young stands. Over three fourths of the board-foot volume in saw-timber stands is in trees 11.0" to 21.0" d.b.h.

Most of the timber cut in South Central Montana in the past has been for railroad ties, fences, and other local needs. The numerous parks and mountain meadows within the forest area provide forage for domestic stock and game.

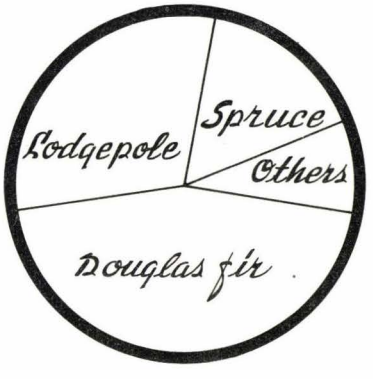
Currently there is much interest in the production of transmission poles and pulpwood. The next three pages illustrate uses of the timber found in the South Central unit.

SOFTWOOD SPECIES MAKE UP **99 %** OF THE BOARD-FOOT AND CUBIC-FOOT VOLUME

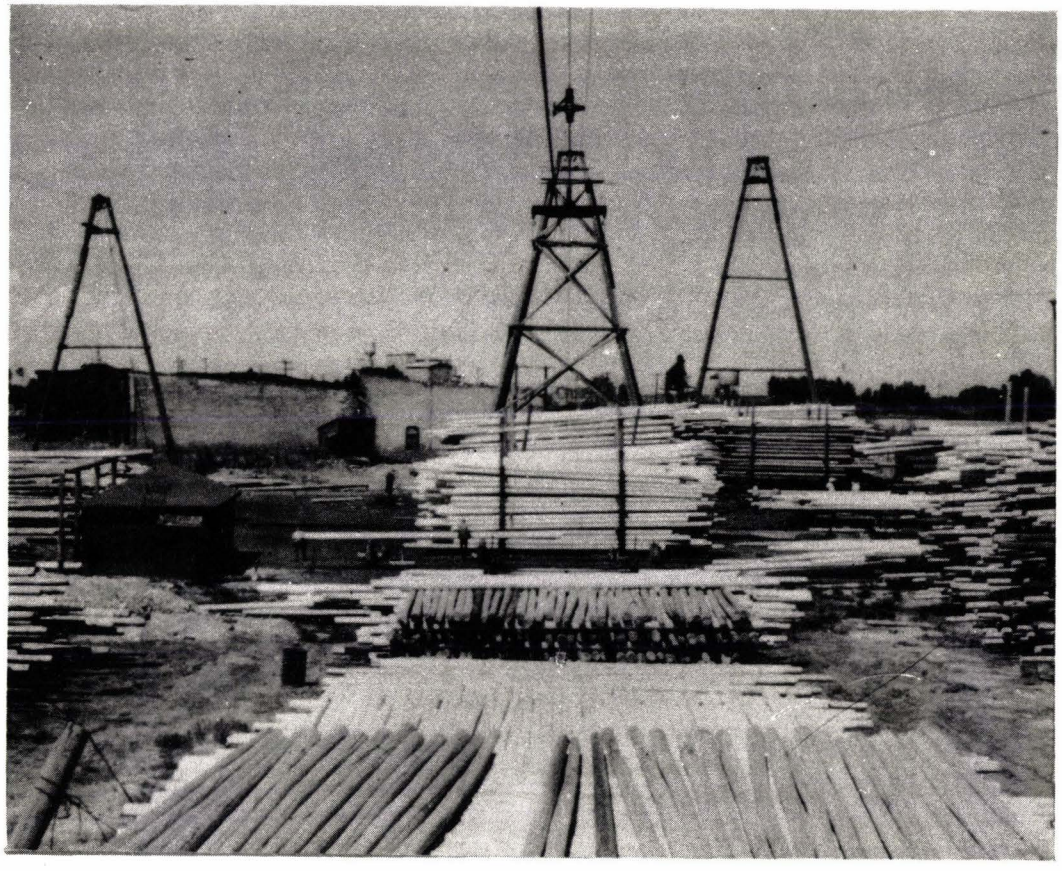


60 % OF THE CUBIC-FOOT VOLUME IS IN POLE-SIZE TREES

THREE SPECIES MAKE UP **91 %** OF THE BOARD-FOOT VOLUME



POLE PROCESSING - A NEW INDUSTRY



The extensive lodgepole pine forests of South Central Montana are a ready timber supply for the expanding demand for transmission poles. One of the advantages of these stands from the standpoint of pole production is their location on the edge of the plains country close to a major market. Straight slender form and ease of preservative treatment have made lodgepole pine attractive to pole producers. Likewise, consumers are attracted by the moderate cost and availability of sizes currently needed. The pole yard above specializes in lodgepole pine — peeling, seasoning, and treating poles for midwest markets.

HIGH QUALITY PULPWOOD

Pulpwood cutting in lodgepole pine started shortly after the end of World War II. High yields of wood pulp per cord of pulpwood have given Montana Lodgepole pine a favorable place in distant markets. In 1948 over 43,000 cords of pulpwood were shipped 1500 miles eastward to Wisconsin. Logging operations vary from hand methods and horse skidding to cutting with power saws and tractor-arch skidding. In the above operation trees are skidded full length, cut to 100-inch sticks by a circular cut-off saw, and loaded by conveyor onto trucks. Note the straight stems and large diameters of the bolts. Large areas of lodgepole pine similar to that in the background of the above picture are to be found in South Central Montana. Such areas offer possibilities for expanding pulpwood production.

80 SAWMILLS OPERATE IN THE UNIT

Small mills similar to this one in Meagher County produced some 30 million board feet of lumber in 1948 mainly for local use. Douglas-fir is the principal sawlog species. Such items as bridge plank, stringers, mine timbers, and rough construction lumber make up the bulk of the fir production. Small mills in the area utilize many low quality sawlogs. Almost no finished lumber is produced in South Central Montana. Next to Douglas-fir in importance as a sawlog species is lodgepole pine. Lumber from this species is of good quality and similar in many respects to ponderosa pine.

Table 1. Forest land area

County	Total area 1/	Total forest land	Commercial forest land		
			Total	Softwood	Hardwood
			-Acres-		
Beaverhead	3,555,840	1,060,554	862,997	846,470	16,527
Broadwater	795,520	187,037	170,777	168,900	1,877
Deerlodge 2/	208,840	129,520	79,373	79,373	--
Gallatin	1,610,880	753,052	528,651	522,328	6,323
Jefferson	1,056,640	479,818	427,083	422,682	4,401
Lewis & Clark 2/	1,782,570	871,438	590,409	582,656	7,753
Madison	2,259,200	605,727	404,695	368,978	35,717
Meagher	1,506,560	498,302	445,361	433,369	11,992
Silver Bow 2/	222,430	121,592	109,202	107,405	1,797
Subtotal	12,998,480	4,707,040	3,618,548	3,532,161	86,387
Percent of subtotal	100.0	36.2	100.0	97.6	2.4
Yellowstone Park in Montana	172,100	139,980	--	--	--
Grand total	13,170,580	4,847,020	3,618,548	3,532,161	86,387

1/ Areas of the United States, 16th Census of United States, 1940.

2/ Includes only the area east of the Continental Divide.

Table 2. Timber volume

County	Saw timber 1/			All timber 2/		
	Softwood	Hardwood	Total	Softwood	Hardwood	Total
	M board feet			M cubic feet		
Beaverhead	2,266,101	10,022	2,276,123	1,269,763	18,385	1,288,148
Broadwater	421,259	1,974	423,233	199,206	2,068	201,274
Deerlodge 3/	111,743	3,406	115,149	86,981	697	87,678
Gallatin	2,346,729	4,359	2,351,088	944,866	7,557	952,423
Jefferson	705,614	9,298	714,912	469,135	6,173	475,308
Lewis & Clark 3/	1,460,916	1,453	1,462,369	589,383	6,347	595,730
Madison	1,335,520	25,326	1,360,846	558,018	22,561	580,579
Meagher	1,606,677	23,970	1,630,647	664,382	9,232	673,614
Silver Bow 3/	439,566	147	439,713	160,144	1,503	161,647
Total	10,694,125	79,955	10,774,080	4,941,878	74,523	5,016,401
Percent of total	99.3	0.7	100.0	98.5	1.5	100.0

1/ Trees 11.0 inches and larger in diameter as measured by International 1/4" rule.

2/ The volume, excluding bark, of sound trees and the sound volume of cull trees from 1-foot stump to a 4.0-inch minimum top diameter including the sound volume of limbwood for hardwood species to a 4.0-inch minimum top diameter.

3/ Includes only that volume on the area east of the Continental Divide.

STANDARD STATISTICAL DATA FOR UNIT
SOUTH CENTRAL MONTANA

Table 3. Land area by major use

Major use	Acres	Percent
Forest land	4,847,020	36.8
Nonforest land 1/	8,323,560	63.2
Total	13,170,580	100.0

1/ Includes 3710 acres of water according to the forest survey standards but defined by the Bureau of the Census as land.

Table 4. Forest land area by economic class

Economic class	Acres		Percent
Commercial forest land		3,618,548	74.7
Noncommercial forest land			
Withdrawn 1/	331,586		
Other 2/	896,886	1,228,472	25.3
Total		4,847,020	100.0

1/ Commercially valuable forest land withdrawn from commercial use for parks, reserves, wilderness areas, etc.

2/ Withdrawn and nonwithdrawn subalpine and other forest lands which, owing to very low productivity, excessively poor quality timber, or extreme inaccessibility, appear to be permanently out of the commercial timber producing class.

Table 5. Commercial forest land by species group and stand-size class

Species group and stand-size class	Acres	Percent
Softwood		
Saw timber	805,173	22.2
Pole	2,301,939	63.6
Seedling-sapling	210,426	5.8
Poorly stocked and denuded	214,623	6.0
Total	3,532,161	97.6
Hardwood		
Saw timber	6,802	0.2
Pole	40,208	1.1
Seedling-sapling	39,002	1.1
Poorly stocked and denuded	375	*
Total	86,387	2.4
Total		
Saw timber	811,975	22.4
Poles	2,342,147	64.7
Seedling-sapling	249,428	6.9
Poorly stocked and denuded	214,998	6.0
Total	3,618,548	100.0

* Less than 0.1 percent.

Table 6. Board-foot volume on commercial forest land by species

Species	Volume	
	M board feet	Percent
Softwood		
Ponderosa pine	408,069	3.8
Western larch	27	*
Douglas-fir	4,873,758	45.3
Alpine fir	170,538	1.6
Engelmann spruce	1,776,498	16.5
Lodgepole pine	3,182,931	29.5
White bark and limber pine	282,304	2.6
Subtotal	10,694,125	99.3
Hardwood		
Aspen	13,390	0.1
Cottonwood	66,496	0.6
Willow	69	*
Subtotal	79,955	0.7
Total	10,774,080	100.0

* Less than 0.1 percent.

Table 7. Cubic-foot volume on commercial forest land by species

Species	Volume	
	M cubic feet	Percent
Softwood		
Ponderosa pine	136,331	2.7
Western larch	5	*
Douglas-fir	1,594,280	31.8
Alpine fir	117,151	2.3
Engelmann spruce	403,794	8.1
Lodgepole pine	2,560,032	51.0
White bark and limber pine	130,064	2.6
Juniper	221	*
Subtotal	4,941,878	98.5
Hardwood		
Aspen	52,774	1.1
Cottonwood	21,714	0.4
Willow	35	*
Subtotal	74,523	1.5
Total	5,016,401	100.0

* Less than 0.1 percent.

Table 8. Board-foot volume on commercial forest land by stand-size class and diameter group

Stand-size class	Volume by diameter group (Inches)			Total
	12 - 20	22 - 30	32 - 40	
	M board feet			
Saw timber	5,444,337	1,375,666	182,910	7,002,913
Pole	3,070,149	481,248	87,223	3,638,620
Seedling-sapling	32,084	6,473	--	38,557
Poorly stocked and denuded	93,780	210	--	93,990
Total	8,640,350	1,863,597	270,133	10,774,080

Table 9. Cubic-foot volume on commercial forest land by stand-size class and diameter group

Stand-size class	Volume by diameter group (Inches)				Total
	6 - 10	12 - 20	22 - 30	32 - 40	
	M cubic feet				
Saw timber	557,908	1,033,804	233,305	31,774	1,856,791
Pole	2,345,374	624,913	89,084	15,964	3,075,335
Seedling-sapling	39,943	8,203	1,222	--	49,368
Poorly stocked and denuded	12,265	20,584	48	2,010	34,907
Total	2,955,490	1,687,504	323,659	49,748	5,016,401

Table 10. Cubic-foot volume on commercial forest land by species group, tree size and class of material

Tree size and class of material	Volume of species group		
	Softwood	Hardwood	Total
	M cubic feet		
Saw-timber trees			
Sawlog portion 1/	1,754,597	12,557	1,767,154
Other 2/	289,126	4,631	293,757
Subtotal	2,043,723	17,188	2,060,911
Pole trees 3/	2,898,155	57,335	2,955,490
Total	4,941,878	74,523	5,016,401

1/ Sound trees only.

2/ Upper stems of sound trees, usable volume of cull trees, and limbwood of hardwood species.

3/ Sound trees and usable volume of cull trees.

Table 11. Average volume per acre by stand-size class

Stand-size class	Average volume per acre	
	Board feet	Cubic feet
Saw timber	8,625	2,287
Pole	1,554	1,313
Seedling-sapling	155	198
Poorly stocked and denuded	437	162
All stands	2,977	1,386

DEFINITIONS

Following are definitions of terms used in this report:

Area Classes

Forest land is land bearing forest growth or land from which the forest has been removed but which shows evidence of past forest occupancy and which is not now in other use.

Commercial forest land is forest land bearing or capable of bearing timber of commercial character and economically available now or prospectively for commercial use and not withdrawn from such use.

Noncommercial forest land is (1) commercially valuable forest land actually withdrawn from commercial use for parks, reserves, wilderness areas, etc., and (2) remote and inaccessible alpine areas, and other land which owing to very low productivity, excessively poor quality timber or extreme inaccessibility appears to be permanently out of the commercial timber-producing class.

Softwood forest consists of stands with 25 percent or more of ponderosa pine or 50 percent or more of other coniferous species. (Based on cubic-foot volume.)

Hardwood forest consists of stands with less than 25 percent of ponderosa pine and 50 percent or more hardwood species. (Based on cubic-foot volume.)

Stand-size Classes

Saw-timber stands include stocked areas with a plurality of the total net cubic volume in trees 11.0 inches and larger in diameter and generally with 2,000 board feet per acre or more in saw-timber trees.

Pole stands include stocked areas in which a plurality of the total cubic-foot volume is in trees from 5.0 inches in diameter to saw-timber size.

Seedling-sapling stands include stocked areas in which the plurality of the total cubic-foot volume is in trees less than 5.0 inches in diameter.

Poorly stocked and denuded stands include areas with less than: (a) 2,000 board feet per acre, (b) 10 percent stocking of pole trees, and (c) 10 percent stocking of seedling-sapling trees.

FOREST SURVEY METHOD

A. The forest resource statistics in this report are based on a field survey made during 1947 - 1949. Briefly the method used in making this survey was as follows:

1. The forest area was determined by an area sampling system which involved measuring and classifying systematically distributed sample segments.

2. The timber volume was determined by measuring the trees found on randomly selected one-fifth acre plots located within the sample segments.

B. The basic data from which the area and volume were determined consisted of the following field samples:

Class	Area		Volume	
	Number of sample segments	Area per sample segment (acres)	Number of plots	Area per sample plot (acres)
I	522	2,560	1,496	1/5
II & III	106	640	146	1/5

C. Distribution of the area sample segments and volume plots was controlled by the following method.

1. The entire area was divided on 1-inch-to-the-mile base maps into three primary classes:

Class I Areas predominantly forest for which aerial photographs were available.

Class II Areas predominantly nonforest for which aerial photographs were available at moderate cost.

Class III Areas predominantly nonforest for which aerial photographs cost more than $2 per print, or for which there were no aerial photographs.

2. Each of the three primary classes was further subdivided into units in the following manner: Beginning with a random selection, Land Office section corners were marked on a base map at 4-mile intervals for areas in Class I, 7-mile intervals for

areas in Class II, and 10-mile intervals for areas in Class III. Thus, the three classes were subdivided into units containing approximately 16, 49, and 100 square miles respectively, each unit centered on one of the section corner control points.

3. The control points were transferred to aerial photo index maps from which photographs were selected to give photo coverage for a segment of each unit containing forest land. For Class-I units the sample segments consisted of four Land Office sections (2,560 acres) centered on the control point, for Class-II and -III units the sample segments consisted of one section (640 acres) lying northeast of the control point.

4. All sample segments containing commercial forest land, including those with doubtful forest cover by photo interpretation and all sample segments without aerial photographs, were examined and mapped in the field. For each sample segment the forest cover was stratified by commercial character, forest type, stand-size, stocking, age, and site classes. The area of these stratifications was determined for each mapped sample segment and was multiplied by sample factors (the area of a class divided by the area sampled in that class) to get the total area by forest condition classes.

5. Timber volume was tallied on three 1/5-acre sample plots in each sample segment of Class I and on two 1/5-acre plots in each sample segment of Classes II and III, that contained commercial forest land. The plots were randomly located in the commercial forest area stratification falling closest to the control point of the sample segment. Total volumes were derived by multiplying average acre volumes for each forest condition and sample segment class by the appropriate areas.

ACCURACY OF THE DATA

In determining the extent of various cover types and stand-condition classes, there are two possible sources of error: (1) errors in classifying the cover of the field samples and in compiling the field data, and (2) sampling errors. The former result from mistakes of judgment or technic and the complexity of the cover which not infrequently grades from one class into another with no clearly defined boundaries. These errors were minimized by the exercise of care and skill, but it is seldom possible to evaluate them. An effort was made to maintain a high order of accuracy and uniformity of standards in the classification, collection, and compilation of sample data, by field checks, by a continuing program of training, and by cross checks in the office.

Sampling errors (standard errors of estimate) on the other hand do not involve human errors but rather are theoretical measures of the reliability of estimates based on the variability exhibited by sample measurements. They generally vary inversely with the square root of the number of samples and directly with the square root of the unsampled proportion of the total population. Hence, they can be controlled by altering either the number of samples, the size of individual samples, or both.

Analysis of sample variations indicate that the standard errors of estimate for the unit as a whole are ± 1.8 percent for total forest land, ± 2.4 percent for commercial forest land, and ± 3.9 percent for noncommercial forest land. Accordingly, the probabilities are 2 out of 3 that the total forest land, commercial forest land and noncommercial forest land are, respectively, within ± 85,000, ± 87,000 and ± 48,000 acres of the estimated areas if measurements and computed errors introduced no bias.

In determining timber volumes, the possible sources of error include in addition to those cited above (3) inaccurate measurement of sample plots, tree diameters, tree heights, and cull, and (4) bias resulting from improper construction, selection, and use of tree-volume tables. All reasonable effort was made to eliminate errors from these sources. The standard error of the cubic-foot volume estimate of the primary growing stock is ± 3.3 percent. Accordingly, the probabilities are 2 out of 3 that the actual volume of the primary growing stock is within ± 163,000 M cubic feet of the estimated volume of 4,939,000 M cubic feet.

The reliability of one statistic as compared with another presented in the same or a related table can be judged roughly by its relative magnitude. In general, the larger quantities warrant greater confidence; the smaller quantities indicate only relative magnitude.

LIST OF FOREST SURVEY REPORTS FOR MONTANA

No.	Forest Survey Statistical Service Series
2	Forest statistics for Lincoln County, 1941
3	Forest statistics for Flathead County, 1941
4	Forest statistics for Lake County, 1941
5	Forest statistics for Sanders County, 1941
6	Forest statistics for Mineral County, 1941
7	Forest statistics for Ravalli County, 1941
8	Highlights of the Missoula County forest situation, 1942
9	Highlights of the forest situation in Lewis and Clark County (west of the Continental Divide), 1942
10	Highlights of the forest situation in Deerlodge County (west of the Continental Divide), 1942
11	Highlights of the forest situation in Silver Bow County (west of the Continental Divide), 1942
12	Highlights of the Powell County forest situation, 1942
13	Highlights of the Granite County forest situation, 1942
14	Highlights of the forest situation in western Montana, 1943
15	Highlights of the forest situation in Chouteau County, 1943
16	Highlights of the forest situation in Fergus County, 1943
17	Highlights of the forest situation in Judith Basin County, 1943
18	Highlights of the forest situation on the national forests of western Montana, 1944

Forest Survey Releases

20	The forest situation in Lincoln County, July 1943
21	The forest situation in Ravalli County, July 1943

Station Papers

12	Forest resource statistics Cascade County, by H. J. Pissot and E. F. Peffer, April 1948
13	Forest resources of Northern Montana, by C. W. Brown and W. C. Hodge, June 1948
20	Forest resources of Southern Montana, by W. C. Hodge, C. W. Brown and T. L. Finch, May 1949
23	Forest resources of South Central Montana, by T. L. Finch, W.C. Hodge and M. E. Metcalf, April 1950

Station Paper No.	
17	Disintegration of girdled western hemlock and grand fir, by Austin E. Helmers. December 1948.
18	Suggested Montana Douglas-fir Christmas tree standards, by S. Blair Hutchison and Ben M. Huey. January 1949.
19	The possibilities of modifying lightning storms in the Northern Rockies, by Vincent J. Schaefer. January 1949.
20	Forest resources of southern Montana, by W. C. Hodge, C. W. Brown and T. L. Finch. May 1949.
21	Forest resources of Northeast Washington, by Paul D. Kemp and H. J. Pissot. May 1949.
22	Bibliography of ponderosa pine, by A. L. Roe and K. N. Boe. March 1950.